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Aconitum krasnoboroffii (Ranunculaceae) – A New Species from the West Sayan Mountain Range, Siberia

Yuichi KADOTA

Department of Botany, National Science Museum
4–1–1 Amakubo, Tsukuba, Ibaraki, 305 JAPAN

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A new species of *Aconitum*, *A. krasnoboroffii*, is described from the West Tannu-Ola Mountains, the West Sayan Mountain Range, Siberia. This species is characterized by having 1) villose pedicels, 2) narrow and short, spike-like terminal racemes in indeterminate condition, 3) trigonous seeds without lamellae, 4) hemispherical helmets with short beaks, 5) slender, long and incurved nectary spurs, and 6) deeply 3-lobed leaf blades with narrowly lanceolate to linear laciniae. A key to *A. krasnoboroffii* and its related species is prepared.

During the period from July to August in 1993, I had a chance to make field observations in the West Sayan Mountain Range, Siberia. In the West Tannu-Ola Mountains, I encountered peculiar aconites. As the results of examinations, it turned out that these plants belong to a new species. The aim of this paper is to describe this new species.

Aconitum (Sect. Napellus) **krasnoboroffii** Kadota, sp. nov. [Figs. 1–3]

Differt ab *Aconito baicalenso* calcaribus nectariorum longioribus, labellis nectariorum ligulatis, rostro casside longioribus, carpellis dense villosis; ab *A. glanduloso* calcaribus nectariorum longioribus, casside hemispherico rostro longiore, carpellis dense villosis.

Herbaceous perennials, 30–60 cm high. Tubers narrowly carrot-shaped to obovoidal, 1.5–3 cm long, 5–12 mm in diameter; rhizomes absent. Stem stout, straight, 3–5 mm in diameter in distal part, erect, glabrous, simple or rarely 1–3 times branched in middle part, usually with a few narrowly carrot-shaped daughter tubers at basal nodes; in case of branching, branches ascending at acute angle to stem and elongated. Leaves subcoriaceous to membranous, roundish pentagonal in outline, deep bluish green to light green on adaxial side, glaucous on abaxial side; radical and lower cauline leaves withering at anthesis; blades 4–6 cm wide, 3.5–5 cm long, deeply 3-lobed; middle lobes obovate rhombic, acute, 1.5–2 cm wide, 2.5–3.5 cm long, deeply pinnatilobate; lateral lobes unequal-sided, ovate, acute, 2–3.5 cm broad and long, deeply divided into two segments; laciniae narrowly lanceolate to linear, acuminate, 1–3 mm broad; leaf bases deeply to shallowly cordate; petioles 0.5–3 cm long, in case of lower cauline leaves up to 6 cm long, almost glabrous. Inflorescence terminal in indeterminate condition, narrowly racemose, 3–5 cm broad, 7–15 cm long, 3–10-flowered, bracteate; bracts foliaceous, deeply 3-lobed to cuneate and tridentate. Pedicels straight, erect or ascending at acute angle to rachis, 0.7–2 cm long, shorter than flowers, densely villose with patent, smooth-surfaced hairs throughout the surface, sometimes with patent, smooth-surfaced glandular hairs around proximal part,

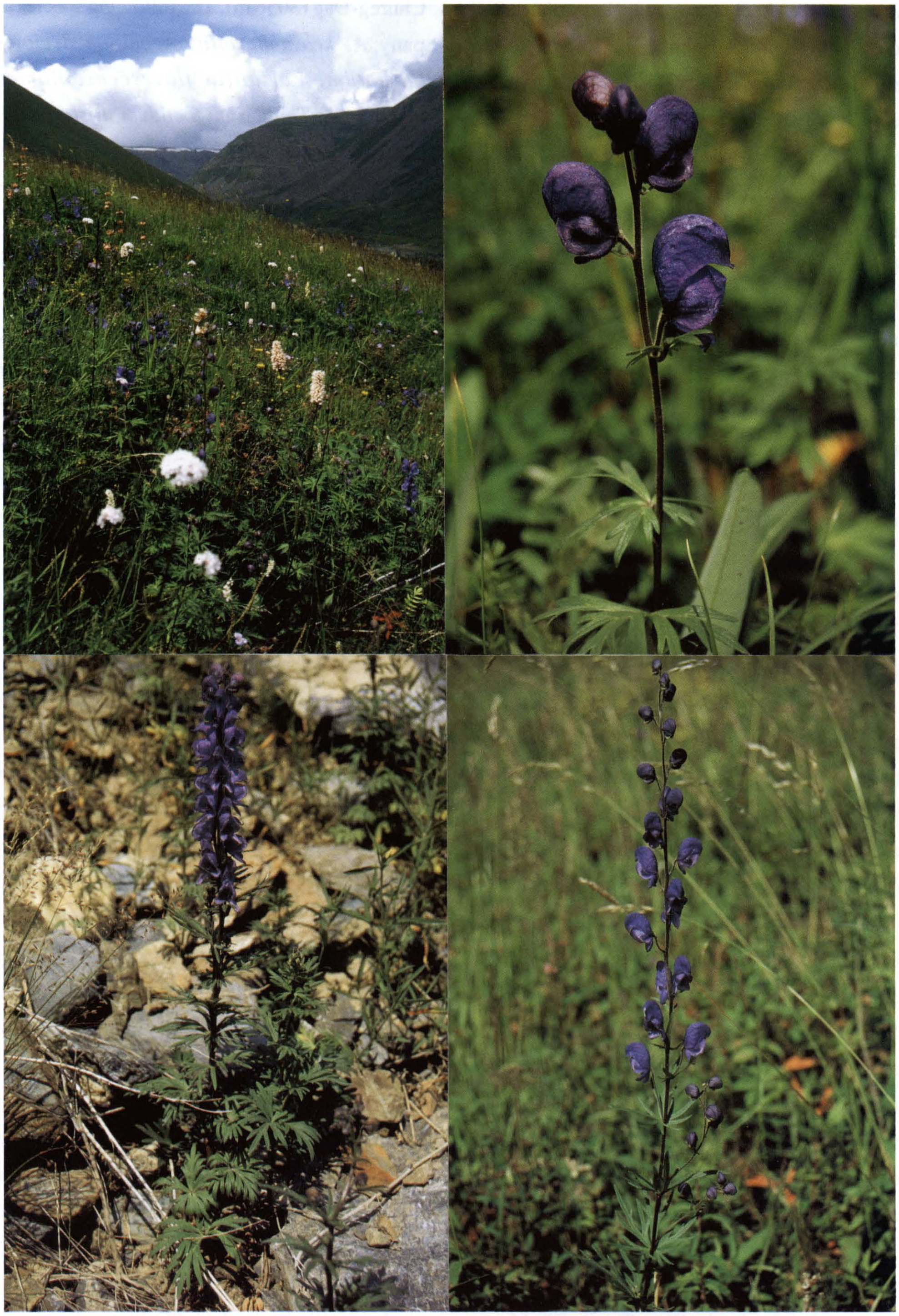

Fig. 1. *Aconitum krasnoboroffii* and the closely related species. Upper left. An *A. krasnoboroffii* population at an elevation of about 2100 m in the West Tannu-Ola Mountains, W. Sayan. Upper right. *A. krasnoboroffii* in the West Tannu-Ola Mountains, W. Sayan. Lower left. *A. glandulosum* in Aktash, Altai. Lower right. *A. baicalense* in the Tumat Taiga Mountains, W. Sayan.

bi-bracteolate; bracteoles narrowly lanceolate, 2–7 mm long, entire, situated above the middle of the pedicels. Flowers blue violet, 35–45 mm high, sparsely villose with subpatent, smooth-surfaced hairs; helmets hemispherical with downward projecting beaks and with concave lower margins, 12–16 mm high, 17–21 mm broad, 19–24 mm tall; lateral sepals roundish, 15–18 mm broad and long, sometimes fringed with cream-colored borders, villose with long, straight and ascending, smooth-surfaced hairs on adaxial side; lower sepals elliptic, obtuse, 2–5 mm broad, 10–14 mm long. Nectaries glabrous or sparsely villose with smooth-surfaced patent hairs; lobes slightly inflated, 2.5–3.5 mm broad, 4–6 mm long; labia ligulate, 4–6 mm long, emarginate, blue violet, reflexed at the apex; stipes strongly incurved, 22–29 mm long; spurs somewhat slender, relatively long and hamately curved up to 270°. Stamens glabrous or very sparsely villose with patent smooth-surfaced hairs, dentate. Carpels 3(–4), densely villose with smooth-surfaced, straight and appressed hairs chiefly on adaxial side, with blue violet styles. Young seeds trigonous, winged along ridges, not lamellate.

TYPE. SIBERIA: Tuwa Republic, Ovurskyi Distr. the West Sayan Range, the West Tannu-Ola Mountains, Mt. Ulug-Dag [91°03'E 50°32'N], in subalpine meadow, alt. 2100 m, 24 July 1993, Wakabayashi et al. 9327095 (holotype-TNS, Fig. 2; isotypes-MAK, TI, NS, LE).

The specific epithet is dedicated to Prof. Dr. I. M. Krasnoborov, Head Curator of the Herbarium (NS), Central Siberian Botanical Garden, Russian Academy of Sciences, in honour of organizing the first Russia-Japan Joint Expedition in the Siberian Mountains.

Aconitum krasnoboroffii is found on slopes in the Terektig River basin, the West Tannu-Ola Mountains, the West Sayan Range (Fig. 1, upper left). It grows in alpine meadows (alt. 2000–2600 m a. s. l.) around the peaks of Mt. Ulug-Dag (2980 m) and Mt. Chureg-Dag (3056 m). The following species accompany *A. krasnoboroffii*: *Aconitum decipiens*, *A. barbatum*, *Pulsatilla flavescens*, *Ranunculus pedatifidus*, *Thalictrum foetidum*, *Bistorta vivipara*, *Hedysarum consanguineum*, *Pedicularis incarnata*, *P. trisits*, *Achillea alpina*, *Senecio pratensis*, *Veratrum nigrum* etc.

I made concentrated field examinations of aconite natural populations in Altai (1992) and West Sayan (1993). Plants belonging to *A. krasnoboroffii*, however, were found only in the Tannu-Ola Mountains. In the area covering Akade-mika Obrucheva and Sangilen Mountains which adjoin the Tannu-Ola Mountains, *A. baicalense* occurs abundantly. Hence there is a possibility that *A. krasnoboroffii* has been confused with *A. baicalense*.

A key to *Aconitum krasnoboroffii* and its related species

1a Helmets hemispherical or galeate with downward projecting short beaks
  2a Helmets hemispherical; nectary spurs long and hamately curved up to 270°; nectary labia ligulate, 4–6 mm long; carpels densely villose with ascending hairs; plants in the alpine zone ....*A. krasnoboroffii* (Fig. 3B)
  2b Helmets galeate; nectary spurs short and saccate; nectary labia roundish, 2–3 mm long; carpels predominantly glabrous; plants in the montane and subalpine zones ....*A. baicalense* (Fig. 3C)
1b Helmet conical to navicular with horizontally projecting long beaks; nectary spurs short and saccate; nectary labia ligulate, 5–6 mm long; carpels predominantly glabrous; plants in the alpine zone ....*A. glandulosum* (Fig. 3A)

Aconitum krasnoboroffii is similar to *A. baicalense* in the helmet shape. However, *A. baicalense* (2n=4x=32; Friesen 1993), the most closest species, occurs in herb stands (open habitats) and forest

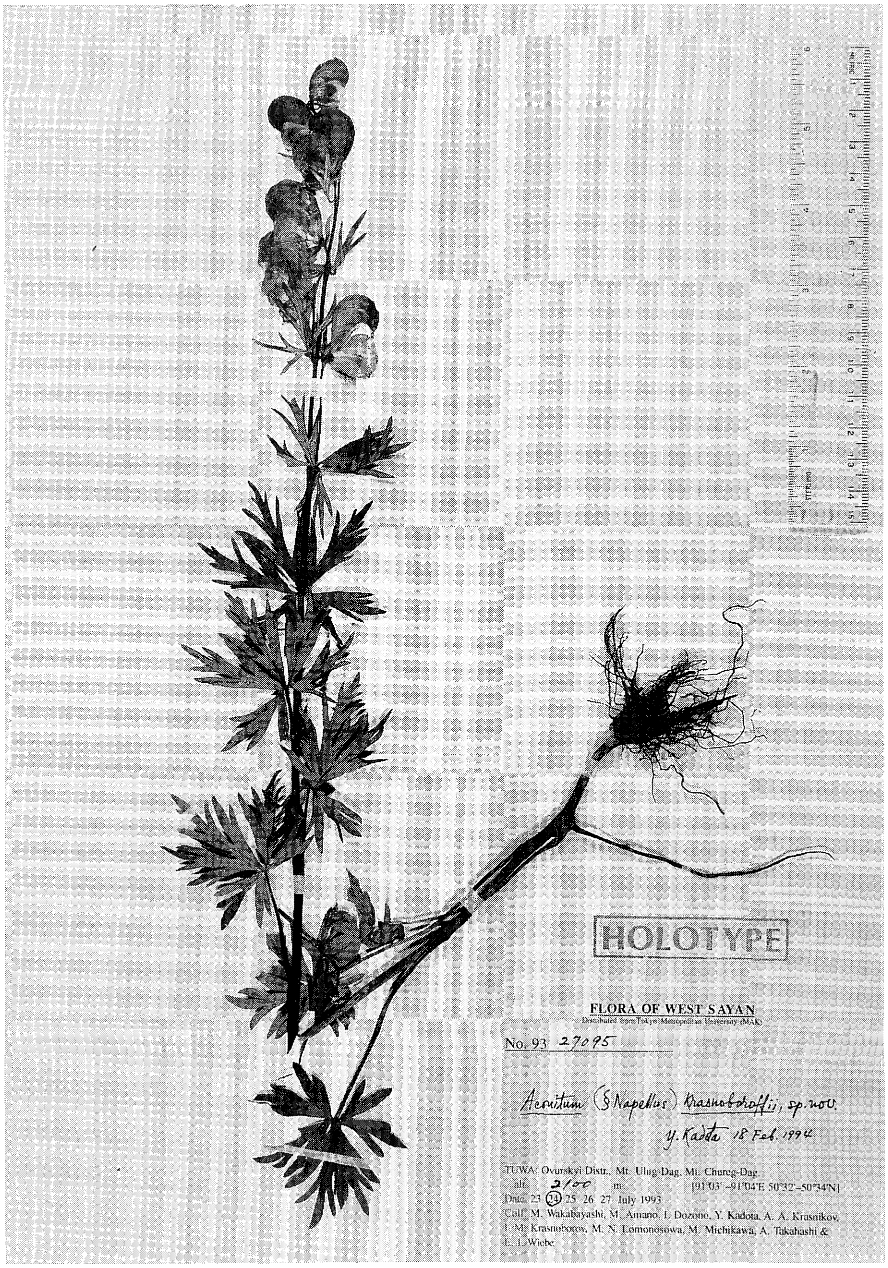
HOLOTYPE
FLORA OF WEST SAYAN
Distributed from Tokyo Metropolitan University (MAK)
No. 93 27095
Aconitum (§ Napellus) krasnoboroffii, sp. nov.
Y. Kadota 18 Feb. 1994
TUWA: Ovurskyi Distr., Mt. Ulug-Dag, Mt. Chureg-Dag
alt. 2100 m. [91°03'–91°04'E 50°32'–50°34'N]
Date 23 ㉔ 25 26 27 July 1993
Coll. M. Wakabayashi, M. Amano, I. Dozono, Y. Kadota, A. A. Krasnikov, I. M. Krasnoborov, M. N. Lomonosowa, M. Michikawa, A. Takahashi & E. I. Wiebe

Fig. 2. Holotype specimen of *Aconitum krasnoboroffii* from the West Tannu-Ola Mountains, the West Sayan Range, Siberia (Wakabayashi et al. 9327095, TNS).

margins (shady habitats) of the montane and the subalpine zones. It attains to 1.5 m high with narrow, spike-like terminal racemes which frequently reach 50 cm or longer (Fig. 1, lower left). When it grows in open habitats, it has an erect stem, while, in shady habitats, the stem becomes declining. The change of habit in this species is an example of the phenotypic plasticity of the tetraploid species group of the genus

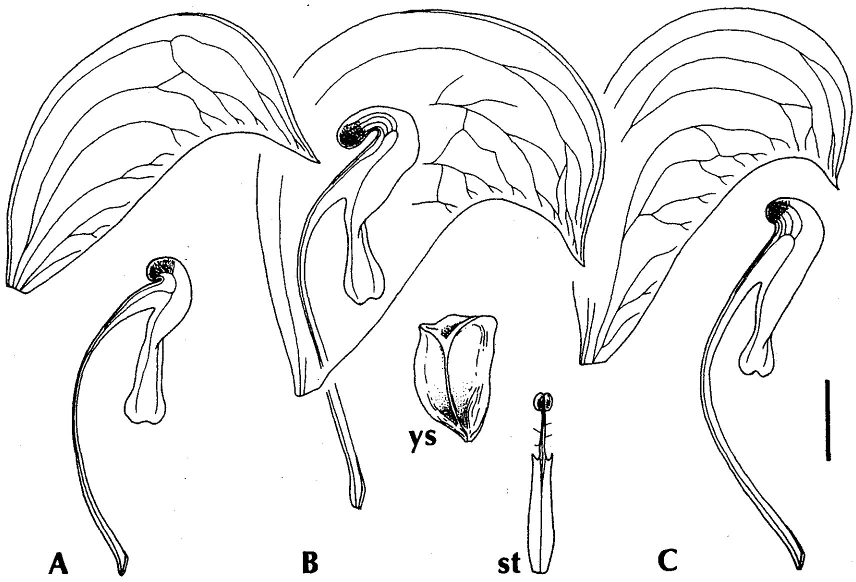

Fig. 3. Helmets and nectaries of three Siberian species of *Aconitum*. A. *A. glandulosum* (Wakabayashi et al. 9270117, 13 July 1992, Aktash, Altai, TNS). B. *A. krasnoboroffii* (Wakabayashi et al. 9327095, 24 July 1993, W. Tannu-Ola, W. Sayan, TNS) ys. Young seed. st. Stamen. C. *A. baicalense* (Wakabayashi et al. 9327148, 31 July 1993, Tumat Taiga, W. Sayan, TNS). Scale indicates 5 mm for helmets, nectaries and stamen, and 1 mm for young seed.

Aconitum (Kadota 1987). *Aconitum glandulosum* (2n=4x=32; Friesen 1993), another species similar to *A. krasnoboroffii*, is an inhabitant of alpine meadows, it always has an erect simple stem, and a short spike-like terminal raceme or corymb (Fig. 1, lower right).

Aconitum krasnoboroffii is an endemic of the Tannu-Ola Mountains, West Sayan. *Aconitum baicalense* extends from West Sayan and East Sayan to Stanovoi Highland and Central Siberian Plateau to the Arctic Circle (Malyschev 1976; Friesen 1993, p. 248, map 117). On the other hand, *A. glandulosum* is distributed in the range from Altai to Khamar-Daban via West Sayan and East Sayan (Friesen 1993; p. 249, map 119). Geographical segregation is recognized among these species though their ranges overlap in some areas. These three species seem to be vicariants.

The first comprehensive work on Siberian *Aconitum* was done by Regel (1861) but he included various different entities under the name of '*Aconitum napellus* L.' Since then Siberian aconites have been revised by several Russian taxonomists but the *A. napellus* complex is still ambiguous. The species group is characterized by having 1) only one annual daughter tuber, 2) blue violet flowers, 3) terminal inflorescence in determinate condition, 4) trigonous seeds without lamellae and 5) villose pedicels. This group belongs to Sect. Napellus of Subgenus Aconitum, and is called "the villose-pedicellate group" in this paper.

In the villose-pedicellate group, the following two species have been recognized; the first species geographically centered in Altai and the second species centered in West Sayan and East Sayan. Russian current floras and manuals treat the first and the second species as '*A. altaicum*' and '*A. czekanovskyi*', respectively (e.g., Steinberg 1937; Woroschilov 1945, 1974; Malyschev 1965, 1976; Krasnoborov 1979; Lomonosowa 1984; Rebushkin 1988). Recently, however, Friesen (1993) revised Siberian aconites and treated the names of *A. altaicum* Steinb. and *A. czekanovskyi* Steinb. as the synonyms of *A. glandulosum* Rapaics and *A. baicalense* Turcz. ex Rapaics, respectively. I also agree to Friesen's treatment based on my observations of the type specimens of *A. altaicum* Steinb. and *A. czekanovskyi* Steinb. (Fig. 4).

Friesen (1993) stated that presence of glandular hairs on the pedicels is one of the diagnostic characters of *A. glandulosum*. It is, however, usual that *A. baicalense* as well as *A. krasnoboroffii* have a certain amount of glandular hairs on their pedicels. There is a tendency that all the species with villose pedicels have glandular hairs on the pedicels. SEM observations showed that, in the case of the falling down of glandular apices, usual patent hairs are hardly discriminated from glandular hairs because both glandular hairs and usual patent hairs equally have smooth surface (Kadota 1981, 1987). The presence or absence of glandular hairs depends on the developmental stages of flowers. It is therefore not appropriate this attribute is employed in the classification of the genus *Aconitum*.

The three species of the villose-pedicellate group (*A. krasnoboroffii*, *A. glandulosum* and *A. baicalense*) undoubtedly have relations to *A. napellus* sensu stricto. Akeroyd and Chater (1993) published their treatment on the *A. napellus* complex based upon the system of Seitz (1969). They distinguished *A. burnatii* from *A. napellus* similarly by the presence of glandular hairs on pedicels. According to their system, *A. krasnoboroffii* is similar to *A. burnatii* Gáyer subsp. *petheri* (Hayek) Jalas native to Balkan Peninsula. They recognized two taxa with glabrous pedicels in *A. napellus*

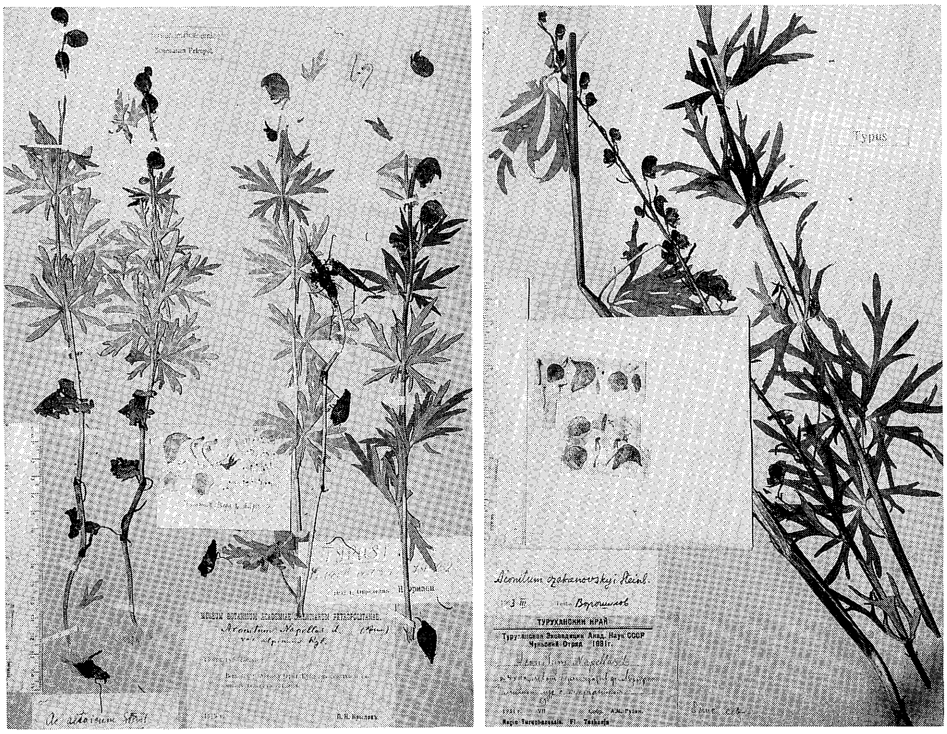

Fig. 4. Holotype specimens of *Aconitum altaicum* and *A. czekanovskyi*. Left. *A. altaicum* Steinb. (Sibiria occidentalis, Oirotia, ad fontes rivi Atryk, 21 July 1915, P. Krylov s.n., LE). Right. *A. czekanovskyi* Steinb. (Sibiria, Prov. Krasnojarsk, in ripa sinistra flum. Czunja, 29 July 1931, A. M. Rubin s.n., LE).

(i. e., subsp. *fissurae* and subsp. *tauricum*). I accept, however, the pedicel pubescence as one of the most important diagnostic characters on the species level in the classification of the genus *Aconitum* based on the observations of Japanese natural populations (Kadota 1987). If the differences of the pedicel pubescence represents that on the subspecific level, the three Siberian species may be included in the *A. napellus* complex.

I wish to show my sincere thanks to the leader of our Altai and West Sayan Expeditions, Dr. M. Wakabayashi, and other Japanese members. My thanks are also to Drs. I. Yu. Koropachinsky, I. M. Krasnoborov, M. N. Lomonosowa, A. A. Krasnikov, V. N. Friesen, and E. I. Wiebe for the fulfillment of both expeditions, and to Drs. V. N. Woroschilov, A. N. Lufelov, I. A. Schanzer, S. S. Kharkevich, N. S. Probatova, V. U. Barkalov, A. E. Kozhevnikov and I. B. Vyshin for helpful discussions and valuable suggestions. I am also grateful to the Curators of the Herbaria (LE, MHA, MW, NS and VLA) for kind permission of herbarium examinations. Field works were supported by the Grant-in-Aids No. 04041087 from the Ministry of Science, Culture and Education, Japan. Herbarium works in Russia (from February to April in 1992) were supported by the Delegation Programs of the Japan Society for the Promotion of Sciences.

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門田裕一：**シベリア・西サヤン山脈産トリカブト属（キンポウゲ科）の1新種**

アジア大陸産トリカブト属植物の分類学的研究の一環として，シベリア西部のトリカブト属の新種***Aconitum krasnoboroffii***を記載した．本種は，1）花梗に開出毛が密生し，2）総状花序が細く長く，穂状かつ無限的で，3）種子には膜状のひだがなく，4）かぶと（上萼片）が半球形で嘴が短く，5）花弁の距は細くかつ長く270°近くにまで内曲し，6）茎葉は三深裂し，裂片も深く欠刻し，終条裂片は狭披針形～線形となる，などの点で特徴付けられる．花梗の有毛性，頂生花序の開花順序，そして茎葉の切れ込みの様式などの点で***A. baicalense*** **Turcz. ex Rapaics**（＝***A. czekanovskyi*** **Steinb.**）と***A. glandulosum*** **Rapaics**（＝***A. altaicum*** **Steinb.**）が本種に近縁である．***A. baicalense*** は花弁の距が短く，唇部が短く，心皮がほとんど無毛で，かぶとが galeate になる点で，***A. glandulosum***

は花弁が全体的に小さく，距が短く，心皮がほとんど無毛で，かぶとが浅い円錐形から船形で，嘴が水平に長く突出する点で本種と区別される．

タイプ標本は西サヤン山脈のなかでも最も南に位置する西タンヌ・オーラ山脈，行政区画ではロシア連邦ツワ共和国から採集された個体である．アルタイ山脈（1992年）と西サヤン山脈（1993年）では集団レベルでかなり詳細な野外調査を実施したが，この山脈以外では見いだすことができなかった．またロシアの主要なハーバリウムでの標本調査でもこの種に当たる個体は収蔵されていなかった．西サヤン山脈の西部に位置するアカデミカ・オブルーチェワ山脈やサンギレン山脈では ***A. baicalense*** が普通に分布するため，本種はこれと混同されていた可能性がある．現在までのところ，本植物は西タンヌ•オーラ山脈の固有種である．